Space Weather Technical Forecast

Issued on Thursday, 05 May 2022 at 01:10 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant geomagnetic activity. Chance of further R1-R2 blackouts, with a slight chance of R3 blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been High over the past 24 hours, due to an M5.7 flare at 04/0900UTC, which originated from AR3004, close to south-centre disc. This region has increased in size and complexity, and is now classified as a Dki/Beta-Gamma-Delta configuration, with one delta spot clearly visible in the HMI magnetogram and HMI intensity imagery. Meanwhile, AR3006 continues to rotate around from the southeast limb, which is making it difficult to analyse at present. This region produced an X1.1 flare on the 3rd May. This region will continue to monitored for further developments, with a better analysis conducted once its rotated fully around onto the southeast quadrant. The two remaining regions are simple Hsx regions in the southwest quadrant which appear to be stable. No Earth-directed CMEs have been observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, observed at L1, continued to show a steady decline to ambient levels, from 415km/s to 350km/s over the past 24 hours. Density has been below average. Total magnetic field strength, Bt, has been weak, with the north-south component also varying weakly. Phi angle was negative (towards the Sun) throughout, with geomagnetic activity Quiet.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at background through the last 24 hours. The high energy electron flux has varied between moderate and high levels, reaching a peak of 1467 pfu at 04/1440UTC. Electron fluence followed a rising trend to briefly exceed the Active threshold at midnight UTC (1.01e8 integrated pfu at 04/0000UTC), before dropping below the Active threshold thereafter.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a chance of further Moderate flares, and a slight chance of Strong flares during the period, from the two active regions mentioned above.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently forecast. Solar wind speeds are now ambient, with no enhancements expected in the forecast period. Geomagnetic activity is expected to be mainly Quiet, with isolated Unsettled intervals.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is at background and is expected to continue at this level through much of the period. However, probabilities have been raised to a very slight chance above background levels. The high energy electron flux (greater than 2MeV) is forecast to continue between moderate and high, or near high, levels through the next four days, but with slightly declining peaks each day. Electron fluence briefly exceeded the Active (1e8 integrated pfu) level at first on 04 May but is now below Active, and expected to show a slow decreasing trend through the remainder of the period.

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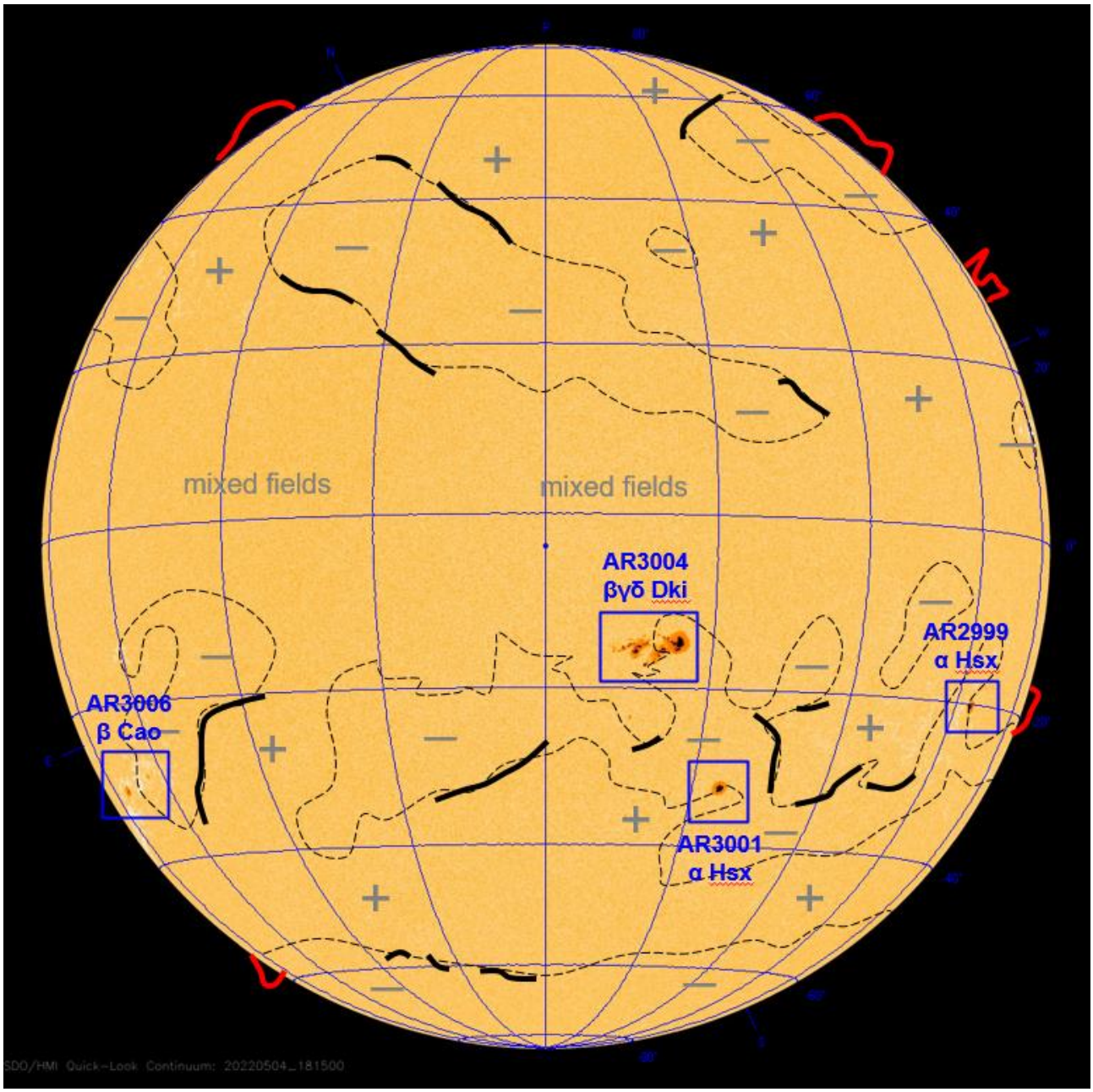
Figure 1. Solar Analysis Valid 04/1815UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs are forecast through the next four days.

Solar wind speeds have settled near ambient levels. There are no further coronal holes in the forecast.

Geomagnetic activity is expected to be mainly Quiet, with a slight chance of an Unsettled interval.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected.

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Radio Blackouts - X-Ray Flares:
Solar activity has been high, due to an M5.7 flare at 04/0900UTC, which originated from AR3004, close to south-centre disc. This region has continued to grow in size and complexity. This region has been classified as a Dki/Beta-Gamma-Delta configuration since previous guidance was issued, with the presence of a delta spot seen in recent HMI magnetogram and HMI intensity solar imagery.

Meanwhile, AR3006 which continues to rotate around from the southeast limb, is currently difficult to analyse due to the angle, and is expected to be quite a complex region once it fully rotates onto the southeast quadrant. This region has already produced an X1.1 flare on the 3rd May. This region is a return of ex-2992, which also produced an X2.2 flare on its previous rotation.

The two remaining regions are simple Hsx regions which appear stable.
Based on the combination of risks there is a further chance of M-class flares, with a slight chance of X-class flares, with flare probabilities adjusted to reflect this.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	50	50	50	50
Very Active	R3 to R5 X Class	No	20	20	20	20

Figure 2: GOES-16 X-Ray flares – shows numberous M-class flares orginating mostly from AR3004 near south-centre disc.

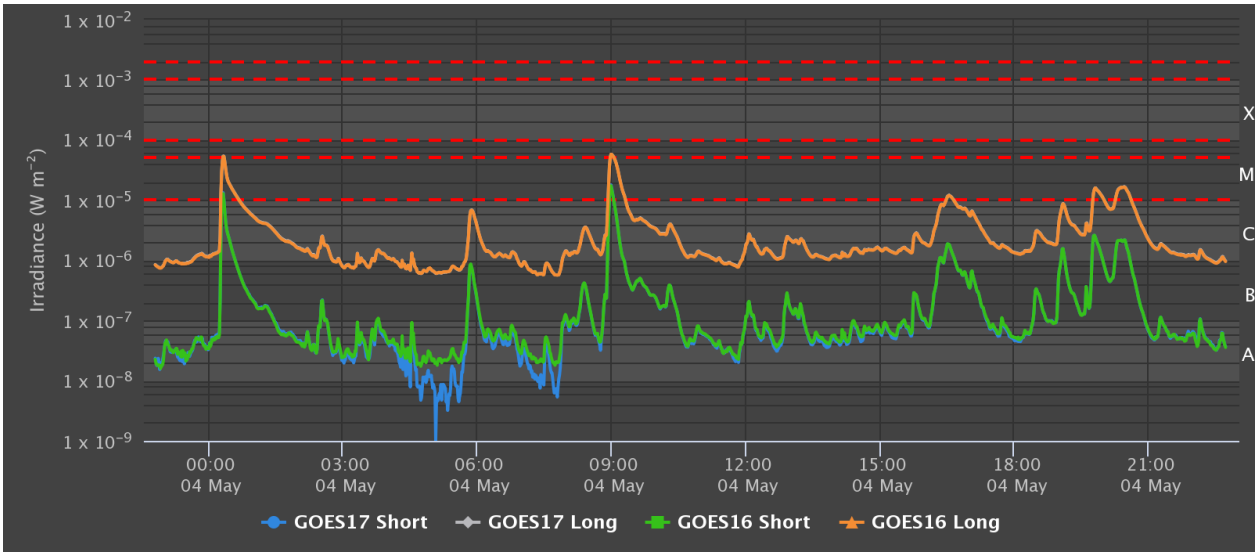

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Figure 3: HMI Intensity and Magnetogram showing AR3004, which is growing in size and complexity, with a Beta-Gamma-Delta configuration. Produced an M5.7 flare – see figure 4.

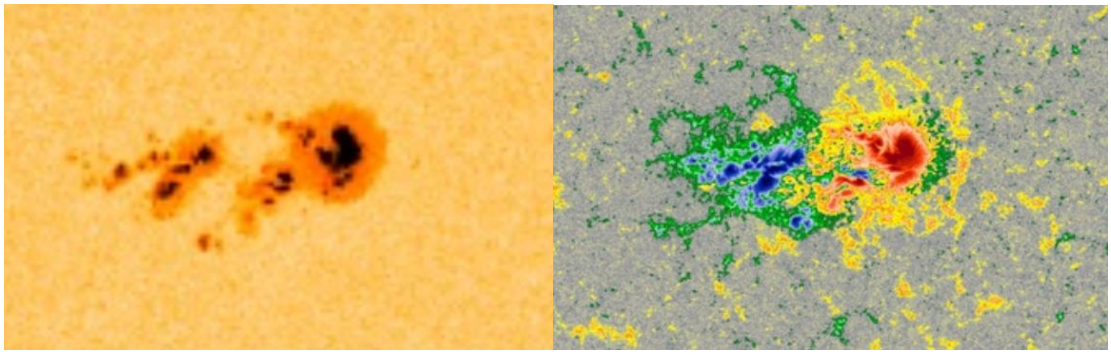
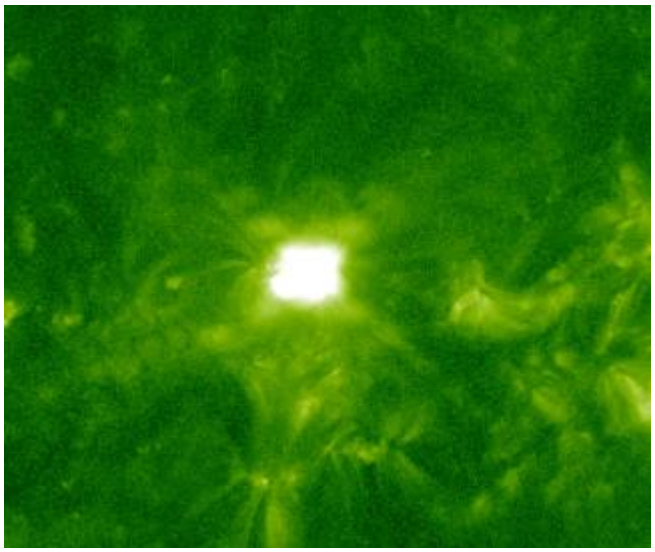


Figure 4: SDO/AIA 94 – shows the M5.7 flare from AR3004 at 04/0900UTC.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is at background levels, and is most likely to remain so through the next four days, although probabilities have been raised to a very slight chance. The region emerging on the southeast limb and developing AR3004 are the most likely candidates to produce proton storms, with AR3004 in the more favourable Earth-directed location.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

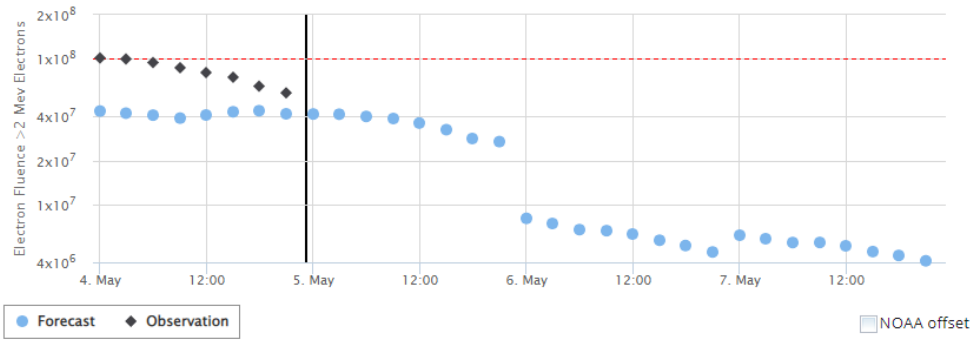
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) is expected to vary between moderate and high, or near high, levels through the next four days, due to the input into the belts from the recent high speed stream. There is likely to be a slight decrease in the diurnal highs, but with peaks nearing, or exceeding, the high threshold mainly early in the period.

During the last 24 hours electron fluence followed a rising trend, briefly peaking at Active levels at midnight UTC, before dropping below the Active threshold. Fluence is now expected to see a slow declining trend through the period, as shown by REFM output. However, observed fluence values are likely to continue above raw REFM values for the short term.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	60	40	30	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: MOSWOC REFM



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